PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P212132PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/NL 03/00931	International filing date *(day/month/year)* 24.12.2003	Priority date *(day/month/year)* 24.12.2003
International Patent Classification (IPC) or both national classification and IPC H04Q7/30, G06F9/46		
Applicant TELEFONAKTIEBOLAGET LM ERICSSON et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
21.07.2005	30.01.2006

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL 03/00931

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

4-33	as originally filed
1, 2, 2a, 3	received on 17.01.2006 with letter of 16.01.2006

Claims, Numbers

1-19	received on 17.01.2006 with letter of 16.01.2006

Drawings, Sheets

1/16-16/16	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-19
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations

   see separate sheet

Concerning Section I,
Basis of the report

Reference is made to the following documents, which are cited in the International Search Report:

D1: US 2003/008684 A1 (FERRIS GAVIN ROBERT) 9 January 2003 (2003-01-09)
D2: WO 01/86440 A (SUN MICROSYSTEMS INC) 15 November 2001 (2001-11-15)
D3: WO 03/015432 A (MORPHO TECHNOLOGIES) 20 February 2003 (2003-02-20)
D4: WO 02/33547 A (GHANEA HERCOCK ROBERT ; BRITISH TELECOMM (GB)) 25 April 2002 (2002-04-25)

Concerning Section V,
Reasoned statement with regard to novelty, inventive step or industrial applicability

1 The present application does not meet the requirements of the PCT, because the subject-matter of **Claim 1** does not involve an inventive step in the sense of Article 33(3) PCT.

1.1 Document D1, which is considered to represent the most relevant state of the art, discloses a radio base station (see D1, abstract, paragraph 11) comprising a monitor (see D1, paragraphs 11, 18, 53, figure 1, element CVM scheduler on the default processing module), memory (see D1, paragraphs 20, 53), and one or more resources (see D1, paragraphs 11, 41, 53), said memory being connected to the monitor and arranged for storing tasks and data (see D1, paragraphs 50, 53, 55), each of said resources being connected to the monitor and arranged for at least one of performing a function and executing a program (see D1, paragraph 50, 56, 58).

1.2 Remark: D3 discloses a similar base station (see references cited in the search report).

1.3 The claimed method differs from the method according to D1 in that the tasks are stored in XML format.

1.4 The problem to be solved by the present invention may therefore be regarded as to find a platform and language independent format for storing the tasks.

1.5 The solution proposed in independent Claim 1 of the present application cannot be considered as involving an inventive step according to Article 33(3) PCT, for the following reasons.

1.6 The person skilled in the art generally knows (e.g. from RFC 1014) the principle of applying platform and language independent external data representation (XDR) for moving software and data objects. The knowledge of this principle would, however, not lead to the claimed use of XML for storing the tasks.

1.7 However, the person skilled in the art looking to solve the above problem would not only apply the general knowledge but would also look into documents dealing with distributed processing and thereby come to document D2. The solution of storing task in XML format suggests itself when having regard to the identical prior art solution disclosed by document D2 (see D2, page 95, lines 6-15, page 96, lines 9-11, 23-31, claims 11 and 15) in order to solve the above indicated problem (see D2, page 7, lines 17-19).

1.8 Thus, the subject matter of independent Claim 1 does not involve an inventive step as required by Article 33(3) PCT.

1.9 **Remarks:**
Concerning D2, it should be noted that if an executable version of the process does not exist on the other device, both the state of the process and the code (threads) defining the process are defined in XML representation for storage and migration (see also D2, page 98, lines 31-39 in combination with the above indicated passages of D2).

In addition, it should be noted that there is no binding definition of "task" and "thread". By contrast, many different definitions exist therefor, see for instance:

- from http://www.cs.man.ac.uk/~rizos/papers/ijhpca/node4.html:
"Task: A unit of work in parallel program that is executed with a single thread".
"Thread is a logical or actual entity that executes tasks of a program".
- from http://www.cs.utah.edu/~regehr/papers/diss/doc-wwwap1.html:
"Task: A single instance of a real-time computation that must complete by a certain time. A real time application may be comprised of several threads, each of which may perform many tasks. Also, in the context of real-time scheduling theory, task is often used to an entity with real time requirements."
"Thread: A flow of control. Kernel threads are supported by the operating system, while user-level threads are implemented outside of the kernel."
- from http://en.wikipedia.org/wiki/Thread_%28computer_science%29:
"Threads are a way for a program to split itself into two or more simultaneously running tasks. Multiple threads can be executed in parallel on many computer systems"
"A Task is an execution path through address space. In other words, a set of program instructions that is loaded into memory"
- faithfully translated from http://de.wikipedia.org/wiki/Thread_%28Informatik%29:
"In the 80s, there have been multitasking operating systems. At that time the term task has been introduced being a synonym for the term thread described here. However, the term task is also as used as synonym for process."

To put it in nutshell, in some operating systems (e.g. newer windows versions, Unix,...) the term "task" is used as synonym for applications/processes scheduled on a higher level to run in parallel (e.g. one program started twice, or several programs started), each task being implemented in form of one or more threads scheduled by the kernel to run in parallel, e.g. in separate time slices or distributed on several processors. On the other hand, in particular in real-time environments, the **term task can also be used as synonym of thread** for implementing processes in a multitasking environment.

2 The subject-matter of the according method **Claim 17** and the corresponding program **Claim 18** does not involve an inventive step in the sense of Article 33 (3) PCT for the same reasons as listed above.

3 The dependent **Claims 2-16 and 19** do not appear to contain any additional features

which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to inventive step, the reasons therefore are that their features have already been employed for the same purpose in the prior art (**Claim 2:** see D1, paragraphs 54, 143, 170, **Claims 3-5:** see D1, paragraphs 8, 55, **Claims 7, 8:** see D1, paragraph 130, **Claims 9, 14-16:** see D1, paragraphs 54 and 210, see D4, page 11, line 19-page 13, line 19, **Claims 10, 11:** see D1, paragraphs 56, 58, 143, 170, **Claim 12:** see D1, paragraphs 67, 68, **Claim 13:** see D1, paragraph 53) or consist of slight constructional changes which come within the scope of the customary practice followed by persons skilled in the art.

4 It is not at present apparent which part of the application could serve as a basis for a new claim which would be in agreement with the PCT. However, if the Applicant regards some particular matter as new and inventive, a corresponding pair of independent claims of different categories including such matter should be filed when entering the national phase. Then, the Applicant should also indicate in the letter of reply the difference of the subject-matter of the new claim vis-à-vis the state of the art (novelty, Article 33(2) PCT) and the significance thereof (inventive step, Article 33(3) PCT). In this case, in order to facilitate the examination of the conformity of the amended application with the requirements of the article of the national law corresponding to Article 34.2(b) PCT (e.g. Article 123(2) EPC), the Applicant is requested to clearly identify the amendments carried out, no matter whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based (see also Rule 66.8(a) PCT).

XML controlled radio base station and method of using such a radio base station

Field of the invention

The present invention relates to improvements in radio base systems. ~~Whereas~~ The present application is directed to programming languages in radio base stations, ~~other aspects of the invention are claimed in co-pending applications:~~

1. ~~System with centralized resource manager (attorneys file number P212562PCT)~~
2. ~~Multisectional bus in radio base station and method of using such a radio base station (attorneys file number P212563PCT)~~
3. ~~Manifold in a radio base station and method of using such a radio base station (attorneys file number P212564PCT)~~

Prior art

Radio Base Stations (RBS) within a mobile telephony system, apart from being arranged to communicate with mobile terminals, are often used as network traffic transfer points to other base stations. Commonly used network topologies for connecting such base stations to each other include chain, ring, and tree topologies. A single transmission link may operate at rates of 2, 4, or 8 Mbit/sec, which is greater than what is used by a single base station. Therefore, multiple base stations often use a single transmission link. Since the physical transmission medium is usually a radio link, base station sites often house radio link equipment as well.

Each base station is typically connected to the transmission network with one or more physical transmission links. The number of links depends on the desired network topology, requirements for redundancy, and the need for transmission capacity at the base station.

Figure 1 shows an example of a RBS 1 according to the prior art (see, e.g., WO01/56235). The RBS 1 as shown comprises a switch 5 that is connected to a plurality of transceivers TRX 29 via internal interface connections 27. The internal interface connections 27 are connected to an internal interface 23. An external interface 21 is connected to ports 3, 7, 25 for external connections. The external interface 21 is also connected to an internal bus 19. The internal bus 19 is also connected to a plurality

of digital signal processors DSP 17, memory units 13, and a central processing unit CPU 12.

The external interface 21, the internal interface 23, the digital signal processors DSP 17, some of the memories and part of the internal bus may be grouped together on a single integrated circuit 9. The central processing unit CPU 12 may be implemented on a single integrated circuit 11. A separate memory unit 14 may be provided for use by the CPU 12 and may be implemented on a separate integrated circuit 15.

For further details as to the operation of the RBS 1 according to figure 1, reference is made to WO01/56235.

Current programming in radio base stations RBSs is either in low level machine code or by means of a higher order programming language. The first is rather complex and the failure density is commonly high. Programming languages have the advantage that the failure density becomes less and, thus, may solve that problem. On the other hand, then, additional steps are required as compiling, linking and loading to get an executable image. None of these do fit directly for the dynamics of runtime assignment of resources. Specially the fact that the monitor system must be able to recognize the program in order to modify for the runtime resource assignment. An other factor is that the program must fit to a series of different versions of radio base stations having in general the same resource types but in which the number and capacity of resources may differ.

<insert page 2a here>

Summary of the invention

The object of the present invention is to use a more flexible programming language in a radio base station.

To obtain this object, the present invention provides a radio base station comprising a monitor, memory and one or more resources, said memory (33, 49) being connected to the monitor and arranged for storing tasks and data, each of said resources being connected to the monitor and arranged for at least one of performing a function and executing a program, ~~wherein said tasks are~~ stored in ~~an~~ XML ~~format~~.

Thus, an XML description is used for passing application specifics to the radio base station. XML is very well suited to define structure, and thus, it can be easily used to describe application structures. The description indicates the functions comprising the application, and how these functions are tied together. Moreover, the XML

characterized in that said tasks are defined and

Publication US 2003/0008684 A1 describes a radio base station, comprising a CVM (= Communications Virtual Machine) scheduler, a memory and one or more recourses, wherein said memory is connected to the CVM schedular and is arranged for storing tasks and data, wherein each of the recourses is connected to the CVM scheduler and is arranged for performing a function and/or executing a program. The CVM shields the hardware from a high level software, such as C++.

Publication WO 01/86440 A2 describes a computer state migration process using a data representation language. A process state may include threads, all objects referred by threads, transient variables created during the execution of the process, objects and their data, etc.

A data representation language representation of the state of a process may be moved from node to node within a distributed computing environment. A representation of the state of a process may also be stored as a data representation language object in a store mechanism, and later retrieved from the store mechanism to resume the process execution on the same or on a different node in the distributed computing environment. A possible data representation language used is XML.

description is used to pass application parameters concerning performance and behaviour that are applied during the process of mapping functions to resources.

The major advantage is that all information about the application's structure and performance requirements is contained in a single, user and machine readable format. There is no need for application specific functionality and therefore variations in the application can be easily made without having to reprogram any part of the radio base station.

In an embodiment, the invention relates to a method of operating a radio base station comprising a monitor, memory and one or more resources, said memory being connected to the monitor and storing ~~XML defined~~ tasks and data, each of said resources being connected to the monitor, said method comprising:

- at least one of performing a function and executing a program by said resources,
- reading one or more ~~XML defined~~ tasks from said memory,
- checking whether resources required for performing said one or more XML defined tasks are available and
- sending commands to selected resources specifying a ~~XML defined~~ task to be performed, characterized in that said tasks are defined in XML.

In a further embodiment, the invention relates to a computer program product storing instructions and data to be loaded by a radio base station comprising a monitor, memory and one or more resources, said memory being connected to the monitor for storing ~~XML defined~~ tasks and data, each of said resources being connected to the monitor, said computer program product, after being loaded, allowing said monitor to:

- read one or more ~~XML defined~~ tasks from said memory,
- check whether resources required for performing said one or more XML defined tasks are available and

send commands to selected resources specifying a ~~XML defined~~ task to be performed, characterized in that said tasks are defined in XML.

Finally, the invention relates to a data carrier comprising such a computer program product.

Brief description of the drawings

The invention will be explained in detail with reference to a plurality of drawings that are only intended to illustrate the present invention and not to limit its scope. The

Claims (amended)

1. A radio base station comprising a monitor (31), memory (33, 49) and one or more resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)), said memory (33, 49) being connected to the monitor (31) and arranged for storing tasks and data, each of said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) being connected to the monitor (31) and arranged for at least one of performing a function and executing a program, characterized in that~~wherein~~ said tasks are defined ~~stored~~ in ~~an~~ XML ~~format~~.

2. Radio base station according to claim 1, wherein said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) that are arranged to execute a program are also arranged to generate trigger signals and send them to the monitor (31), said monitor (31) being arranged to receive said trigger signals, to read one or more tasks related to said trigger signals from said memory (33, 49), to check whether resources required for performing said task are available and sending commands to selected resources specifying the task to be performed.

3. Radio base station according to claim 1, wherein connections between said memory (33, 49) and said monitor (31), and between said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) and said monitor are implemented by means of a bus (51).

4. Radio base station according to claim 3, wherein said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) are arranged for mutual communication via said bus (51).

5. Radio base station according to claims 3 or 4, wherein using the bus (51) comprises~~is based on a~~sending datagrams ~~principle~~.

6. Radio base station according to any of the preceding claims, wherein said memory (33, 49) comprises a task memory (33) and a data memory (49).

7. Radio base station according to any of the preceding claims, wherein said monitor (31) comprises a state machine sequencer (79) for handling several state machines in parallel.

8. Radio base station according to claim 7, wherein said memory comprises a ROM portion (61) and a RAM portion (59), said ROM portion (61) storing state machine definitions for said state machine sequencer (79), task definitions and default structures, said RAM portion (59) storing dynamic data.

9. Radio base station according to claim 8, wherein said RAM portion (59) stores a resource allocation table (63), a data block list (65), and data blocks (67).

10. Radio base station according to any of the claims 1-8, wherein said monitor (31) comprises an executor (77) arranged for:

- sending commands to resources;
- sending task block requests to memory (33, 49);
- receiving status information from resources;
- receiving task blocks from memory (33, 49).

11. Radio base station according to claim 9, wherein said monitor (31) comprises an executor (77) arranged for:

- sending commands to resources;
- sending task block requests to memory (33, 49);
- receiving status information from resources;
- receiving task blocks from memory (33, 49);
- maintaining said resource allocation table (63).

12. Radio base station according to any of the preceding claims, wherein said resources comprises at least one of: a transmitter (35(i)), a receiver (37(j)), an analogue signal manifold (39(k)), a digital analogue converter (41(m)), an analogue digital converter (43(n)), a control unit (45(o)), and a digital signal processor (47(p)).

13. Radio base station according to claim 12, wherein said resources comprise at least one digital signal processor (47(p)) storing an executable image for performing a program.

14. Radio base station according to any of the preceding claims, wherein said XML defined tasks are described in XML~~comprise~~ bricks created with document template definitions.

15. Radio base station according to any of the preceding claims, wherein said XML defined tasks comprise at least one of: task name, priority, definitions of resources required, definitions of channels between resources, definitions of data blocks to be used, definition of commands for resources, definitions of code segments to be used by processors of resources, and status of resources.

16. Radio base station according to claim 15, wherein said definitions of data blocks have the following structure definition:

```
STRUCTUREDEFINITION.DTD
<!ELEMENT structuredefinition (structurename, structureblock)>
<!ELEMENT structurename (# BLOCKNAME)>
<!ELEMENT structureblock (# TEXT)>

BLOCKLIST.XML
<structuredefinition>
 <structurename> blocklist </structurename>
 <structureblock>

 "Contents of block in text"

 </structureblock>
</structuredefinition>
```

17. Method of operating a radio base station comprising a monitor (31), memory (33, 49) and one or more resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)), said memory (33, 49) being connected to the monitor (31) and storing ~~XML defined~~ tasks and data, each of said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) being connected to the monitor (31), said method comprising:

- at least one of performing a function and executing a program by said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)),
- reading one or more ~~XML-defined~~ tasks from said memory (33, 49),
- checking whether resources required for performing said one or more ~~XML-defined~~ tasks are available and
- sending commands to selected resources specifying a ~~XML-defined~~ task to be performed,

characterized in that said tasks are defined in XML.

18. Computer program product storing instructions and data to be loaded by a radio base station comprising a monitor (31), memory (33, 49) and one or more resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)), said memory (33, 49) being connected to the monitor (31) for storing ~~XML-defined~~ tasks and data, each of said resources (35(i), 37(j), 39(k), 41(m), 43(n), 45(o), 47(p)) being connected to the monitor (31), said instructions ~~computer program product, after being loaded, allowing~~for said monitor (31) ~~to~~comprise:

- reading one or more ~~XML-defined~~ tasks from said memory (33, 49),
- checking whether resources required for performing said one or more ~~XML-defined~~ tasks are available and
- sending commands to selected resources specifying a ~~XML-defined~~ task to be performed,

characterized in that said tasks are defined in XML.

19. A data carrier comprising a computer program product according to claim 18.

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